DOCUMENT RESUME

ED 159 463 CE 018 037

AUTHOR Bebeau, Muriel J.; Sullivan, Howard J.
TITLE Effects of Student-Preferred Incentives in University Courses.
INSTITUTION Arizona State Univ., Tempe. Dept. of Educational Technology and Library Science.
SPONS AGENCY Air Force Human Resources Lab., Brooks AFB, Texas.; Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
REPORT NO AFHRL-TR-78-17
PUB DATE May 78
CONTRACT F41609-75-C-0028
NOTE 56p.; Some pages in this document may not reproduce well due to poor print quality; For a related document see CE 018 036

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Courses; Higher Education; Learning Motivation; *Memory; *Rewards; *Student Motivation; Task Performance; *Transfer of Training; Undergraduate Students
IDENTIFIERS Educational Incentives; Learning Incentives

ABSTRACT

Three experiments were conducted to determine the effects of student-preferred incentives across instructional tasks that varied in length and relatedness to course content. The first study was done to determine the effects of the opportunity to earn points toward the course grade. There were no differences between incentive and no-incentive students on any measure. Experiment 2 was designed to investigate the effects of student-selected incentive on student's posttest performance and study time across two instructional tasks related to course content. Incentive students performed better than no-incentive students on program subtests which required stating lists of rules that could be committed to memory. Experiment 3 was done to determine the effects of a highly preferred incentive, release from final examination, when used under instructional procedures in a two-week instructional unit. Effects of the incentive were studied on posttest performance, study time, student-initiated contact with instructor, and student attitude toward the incentives used. Students in the no-incentive condition scored higher than incentive students on a constructed-response subtest that required new rules applications. The evidence suggests that incentives are effective for memory-type tasks, particularly when the student is aware that rehearsal and memory are task requirements. (CSS)

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EFFECTS OF STUDENT-PREFERRED INCENTIVES IN UNIVERSITY COURSES

By

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This final report was submitted by Arizona State University, Tempe, Arizona 85281, under contract F41609-75-C-0028, project 2313, with Flying Training Division, Air Force Human Resources Laboratory (AFSC), Williams Air Force Base, Arizona 85224. Mr. Gary B. Reid, Flying Training Research Branch, was the contract monitor.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFHRL-TR-78-17	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) EFFECTS OF STUDENT-PREFERRED INCENTIVES IN UNIVERSITY COURSES		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Muriel J. Bebeau Howard J. Sullivan		8. CONTRACT OR GRANT NUMBER(s) F41609-75-C-0028
9. PERFORMING ORGANIZATION NAME AND ADDRESS Arizona State University Tempe, Arizona 85281		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 2313T501
11. CONTROLLING OFFICE NAME AND ADDRESS HQ Air Force Human Resources Laboratory (AFSC) Brooks Air Force Base, Texas 78235		12. REPORT DATE May 1978 13. NUMBER OF PAGES 56
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Flying Training Division Air Force Human Resources Laboratory Williams Air Force Base, Arizona 85224		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

educational incentives
incentive preferences
learning incentives
motivation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Three experiments were conducted to determine the effects of student-preferred incentives across instructional tasks that varied in length and relatedness to the course content. Dependent measures included posttest performance, study time, and student reports of effort. The incentives selected for use in each experiment were based upon recent normative data on incentive preferences of university students. Sixty-four undergraduates enrolled in an upper-division education course) participated in Experiments 1 and 2. In the first study, the opportunity to earn points toward the course grade for acceptable posttest performances was used as an incentive. No significant differences between incentive and no-incentive students were obtained on any dependent measure for either a course-related or a non-course-related instructional program. In the second study, performance of students,

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each of whom was allowed to select his or her preferred incentive from among several alternatives, was compared with performance of students in a no-incentive treatment on two course-related instructional programs. Incentive students performed significantly ($p < .004$) better than no-incentive students on certain program subtests—subtests that required the student to state lists of rules that could be committed to memory. In Experiment 3, the effect on student performance of release from final examination was investigated under typical instructional conditions in a university course. Fifty-nine students studied self-instructional materials and attended optional practice sessions during a three-week unit of instruction that was a regular part of the course. In this experiment, students in the no-incentive condition scored significantly higher ($p < .04$) on a constructed-response subtest that required new applications of rules than did students in the incentive condition. As in a typical course, posttest scores were applied to the course grade for all students, but only students in the incentive condition could earn release from the final examination for acceptable performance on the test. One finding from Experiment 2 relates to the selection of incentives for classroom use. Grade-related and non-grade-related incentives were described in this experiment in a manner designed to have high appeal for students enrolled in the course. The sharply lower ratings given potential incentives that were not grade-related (e.g., assisting the instructor, attending a small group discussion with an authority on a high-interest topic) was consistent with earlier normative ratings of potential incentives obtained by the author from university students in psychology and education courses. However, points toward the course grade were preferred over release from a rather comprehensive final assignment in the present study, whereas subjects in the normative studies had rated release from the final examination higher than points toward the course grade. Evidence from these experiments and previous research indicates that incentives are effective for memory-type tasks, particularly when the student is aware that rehearsal and memory are task requirements. The unanticipated negative effect of incentives in Experiment 3 on a task that required new applications of rules suggests a need for additional investigations of the generalizability and reliability of this effect.

PREFACE

This research was conducted under project 2313, Human Resources; task 2313-T5 Information Processing and Cognitive Components of the Flying Task.

Air Force training programs frequently use intrinsic incentives and competition (e.g., class standing) as motivators. This basic research, while dealing with incentives somewhat different than those used in Air Force Training, is directed toward understanding how incentives function and how they can be employed more effectively. The research was carried out under provisions of contract F41609-75-C-0028 by the Department of Educational Technology and Library Science, Arizona State University. The Air Force contract monitor was Gary B. Reid.

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EFFECTS OF STUDENT-PREFERRED INCENTIVES IN UNIVERSITY COURSES

INTRODUCTION

Recent research in instructional psychology is rapidly undermining Thorndike's principle of learning: Rewards function to improve learning (McKeachie, 1974). Some studies investigating incentive effects on learning tasks indicate that incentives do not always facilitate performance (Hiller, Deichman, & Pirkle, 1973; Komaki, 1973; Sullivan, Baker, & Schutz, 1967; Tenpas & Higgins, 1974; Bebeau & Eubanks, Note 2) and at times have a decremental effect (Eubanks, 1976). Negative effects of incentives on problem-solving tasks (Deci, 1971, 1972) and proof-reading tasks (Wolk & DuCette, 1974) have also been observed.

A significant issue related to effective instruction in college courses is the extent to which available incentives can be used to enhance student achievement. Few studies have investigated the use of incentives in classroom settings for adult learners. Laboratory studies of incentive effects have limited generalizability to instructional settings. Grade-related contingencies present in the classroom are seldom present in laboratory studies, and the incentives used to motivate performance in laboratory studies often are not readily available to university instructors.

Komaki (1973) investigated the effects of incentives that are available to instructors in university courses. In her study, delivery of student-selected incentives was contingent upon high performance on quizzes that preceded a unit test. Incentives had a marginal effect on performance in one of three courses. Komaki attributed the lack of differences to a ceiling effect. Other possible explanations for the failure to obtain a significant incentive effect are that (a) the classroom deliverable incentives were not of sufficient strength to significantly affect performance, (b) the course grade was so powerful that incentive effects were masked, and (c) the frequent testing procedures used in the study effectively controlled study behavior and thus moderated the potential effect of the incentive.

Although researchers often investigate the effects of varying levels of a particular incentive (Frase, Patrick, & Schumer, 1970; Halcomb & Blackwell, 1969; Lloyd, Garlington, Lowry, Burgess, Euler, & Knowlton, 1972), the learner's perception of the desirability of different incentives is seldom investigated or reported. Sullivan, Schutz, and Baker (1971) demonstrated that in one instructional program the effect of an incentive was directly related to the desirability of the incentive.

Until recently, normative data were not available on the preferences of students for incentives commonly used by an instructor. Surveys of student preferences for incentives available for use in college classrooms (Bebeau, Eubanks, & Sullivan, in press; Bebeau, Sullivan, & Eubanks, 1977) revealed that incentives often used in university courses are not those most preferred by students. For example, these data indicate that the opportunity to serve as a course proctor, offered in many personalized system of instruction (PSI) courses, is not highly preferred by students. Similarly, the opportunity to have first choice among a selection of seminars, offered in a computer-assisted instruction (CAI) course at the University of Illinois (Anderson, Note 1), was not a highly preferred incentive in the normative studies. In the context of Anderson's CAI course, however, the seminar may be more powerful than indicated by the normative data.

Several experimental studies have investigated the effects of the types of incentives rated in the incentive-preference studies by Bebeau et al. (in press; 1977). The results of the experimental studies are generally consistent with the preference data obtained by Bebeau et al. in that highly preferred incentives facilitated performance, whereas incentives with lower preference ratings were less effective. The Bebeau studies indicate that grade-related incentives are highly preferred by students. Gold, Reilly, Silberman, and Lehr (1971) found that academic performance of students is superior when they operate under a traditional grading system as opposed to a pass-fail system. The findings of Lloyd et al. (1972) indicated that college students attend lectures with greater frequency when "points toward course grade" are used as an incentive. The Bebeau et al. data indicate that social incentives (praise, recognition, etc.) were moderately preferred by university students. When selected on the basis of Air Force trainee preference data collected by Wood, Hakel, Del Gaizo, and Klimoski (1975), social incentives improved trainee attitudes (Hakel, Klimoski, & Wood, 1975), but not academic achievement. The Bebeau data also indicate that field trips, recognition, and opportunities to assist the instructor are less preferred than grade-related and social incentives. When Komaki (1975) offered events such as choice of projects, opportunities for extra credit work, and conferences with the instructor as rewards for performance on optional reading assignments, these events were not selected by college students. Grade-related events were selected and did enhance performance.

The general purpose of the present research was to determine the effects of preferred incentives on performance across instructional tasks that vary in length and relatedness to the course content. In the first study, the effects of a preferred incentive, "points toward course grade" (Bebeau et al., 1977), were investigated for two instructional tasks. A course-related task was selected to determine whether incentives improve posttest performance in situations where a student is already motivated by the consequences of a course grade. A task unrelated to the

course was selected to determine the effect of an incentive when the student had no course-related reason for learning the task. The objective of the second study was to determine whether performance on course-related tasks is improved by allowing each student to select the incentive he or she will receive for acceptable performance. The incentives offered were specific instances of the types of incentives rated in the Bebeau et al. (in press; 1977) studies. The purpose of the third study was to investigate the effects of a preferred incentive on student performance in a unit of instruction that is a regular part of an on-going course. In each study the effects of incentives on posttest performance and study time were observed.

EXPERIMENT 1

The purpose of the first study was to determine the effects of availability of points toward the course grade in a program that was a part of the instruction for a course and one that was not. The effects of the "points toward course grade" incentive were studied on student posttest performance, errors in the instructional program, study time, and attitudes for the course-related program and the unrelated program.

Method

Subjects

Subjects for Experiment 1 were 64 graduate and upper-division undergraduate students enrolled in the Competency-Based Instruction course at Arizona State University during the fall semester, 1976. Participation in the experiment was a required class activity.

Materials

The materials used in the experiment* were a modified version of "Modern Measurement" by Popham (1973) and a modified version of the 30-frame program "The Structure and Function of the Human Eye" by O'Day, Kulhavy, Anderson, and Malzynski (1971). Students received feedback on the practice items contained in these programmed booklets by using mark-sensitive answer sheets and a special pen for recording responses.

The posttest for the Measurement Program consisted of five constructed-response items and 32 two-alternative selected response items. The program did not include practice on the constructed-response items but instructional objectives preceding the program indicated that such items would be present on the posttest. On the selected-response items, the student was asked to determine which of a pair of concepts was an appropriate solution for a given situation. The selected-response practice items in the program were similar, but not identical, to those on the test. Instruction was contained in the program for all test items of both types.

The posttest for the Eye Program consisted of the same 30 five-alternative, multiple-choice items presented during instruction. The order of items and the order of the alternatives were randomized on the posttest, and consequently differed from their order in the program.

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*Copies of the modified programs used in all three experiments have been placed on file with Department of Educational Technology, Box FLS, Arizona State University, Tempe, Arizona 85281, and may be obtained upon request.

An attitude survey, consisting of nine statements about the instruction and use of the incentive, was administered after each program posttest (Appendix A). Statements on the two surveys were identical except for references to the program title. Students indicated on a five-point scale the degree to which they agreed or disagreed with each statement.

Procedures

In a class period preceding the experiment, students were told that in the next two class meetings they would complete two instructional programs which would serve as a basis for discussions of instructional principles. They were informed that (a) one program taught content relevant to the current unit of instruction, (b) the other program taught content unrelated to the course content, and (c) participation in both programs was desirable for an understanding of certain instructional principles that would be presented later in the course.

Upon arrival in class on the day of the experiment, students were randomly assigned envelopes containing one of four sets of experimental materials. Directions on the envelope indicated assignment to one of two classrooms, a procedure used frequently during the course for group discussions. The incentive and no-incentive treatments were conducted in separate rooms to insure that students in the no-incentive condition were unaware of the incentive treatment. Also, separating students insured that students in the incentive condition would not be influenced by no-incentive students who might complete the program more quickly. Procedures in the two classrooms were identical, except that students in the no-incentive condition were not informed until after they had completed their program that they would subsequently have the opportunity to earn points toward their course grade. Likewise, students in the incentive group were not informed until after they had completed their assigned program that they would subsequently complete the alternative program under a no-incentive condition.

Written directions at the beginning of each instructional booklet were read aloud. These directions, which are contained in Appendix B, indicated that students would be tested over the program as soon as they completed it and that only the content covered in the Measurement Program would be assessed again at a later date--on the unit test and on the final examination. Students in the incentive condition were told that they could receive 10 points toward their course grade if they did well on the test. All students were directed to record the time (written on the chalkboard by an experimenter at 30-second intervals) when they finished the instruction.

After the reading of directions, students worked through the program and recorded the time at which they completed it. After testing, which included completing the attitude survey, students were informed

of the incentive condition and directed to report to the alternative classroom (two days later) to complete a second instructional program for the next class meeting.

The purpose of the second session was to give the students who were in the no-incentive group for the first meeting an opportunity to earn the incentive. Procedures used in the follow-up session were identical to those used in the experimental session. Because the incentive-group students from the experimental session were now aware that the other students could receive an incentive for the follow-up session, while they could not, it was expected that this awareness might negatively affect their (i.e., the incentive-group students from the experimental session) effort and performance. Therefore, the follow-up session was not intended as a part of the experiment. However, data are also reported in the results section of this session because post hoc analyses revealed some findings that were different from those obtained in the experimental session.

Results

The posttest scores, program errors, study times, and attitude scores were analyzed using a 2 x 2 multivariate analysis of variance. The factors for the analysis included incentive treatment (incentive and no-incentive) and program (course-related and unrelated). Posttest scores were converted to standard scores for purposes of the analysis because the total points possible differed for the two program tests.

The multivariate F tests indicated that neither the main effect for incentive, F (12, 49) = 1.15, p <.34, nor the main effect for program, F (12, 49) = 1.58, p <.13, was significant. The interaction between incentive and program was also not significant, F (12, 49) = 1.16, p <.34.

Posttest Scores

Mean scores for each of the dependent variables on the course-related (Measurement Program) and unrelated program (Eye Program) are shown in Table 1. Standard scores were used for a comparison of the main effects on the posttests. The mean standard score for students in the incentive group was 52.22 and the mean for students in the no-incentive group was 47.78. On the course-related program, the mean posttest score for the incentive group was 36.00 and the mean for students in the no-incentive group was 33.75. On the unrelated program, the mean posttest score for the incentive group was 22.88 and the mean for students in the no-incentive group was 20.50. The mean percentage correct across treatments was 79 percent on the course-related program and 72 percent on the unrelated program. Examination of the univariate tests revealed that none of the differences in posttest performance approached significance.

Errors

On the course-related program (Table 1), the mean number of in-program errors for the incentive group was 4.75, while the mean number of in-program errors for the no-incentive group was 3.56. On the unrelated program, the mean number of errors for the incentive group was 5.06 and the mean number of errors for the no-incentive group was 4.56. The univariate tests for these differences were not significant for either program.

Study Time

Comparisons were made to determine whether the incentive or the type of program influenced the amount of time that students spent studying. Mean study times were very similar, varying by only one minute among the four treatment groups.

Attitude Scores

Responses to the attitude survey administered after both the experimental and follow-up sessions are summarized in Appendix A. Students studying the unrelated program gave significantly higher ratings (2.38 on the scale of 1 for the highest rating to 5 for the lowest rating) than students studying the related program (3.00) to an item dealing with the clarity of instruction (Item 6). Students studying the related program rated their level of effort (Item 9) significantly higher than students studying the unrelated program. No significant differences in attitude were observed between the incentive treatment groups.

Follow-up Session

Attendance at the follow-up session was higher than expected for students who had the opportunity to earn an incentive on the course-related program during the experimental session, and observations of effort suggested that awareness of the experimental conditions did not result in a significant reduction of effort by these students during the follow-up session. Therefore, post hoc analyses were conducted for this session. All but four students attended the follow-up session, and these four students made arrangements prior to the session to complete the appropriate program at another time.

The multivariate F test indicated that both the main effect for incentive, $F\ (12, 49) = 2.55$, $p < .01$, and the main effect for program, $F\ (12, 49) = 4.52$, $p < .0001$, were significant in the follow-up session. No interaction between incentive and program was observed.

Table 1

Means of Dependent Variables by Incentive and Program:

Experimental Session, Experiment 1

	Posttest Scores			Program Errors			Instructional Time in Minute		
Treatment	Related	Unrelated	Totals	Related	Unrelated	Totals	Related	Unrelated	Totals
Incentive	36.00	22.88		4.75	5.06	4.90	37.94	38.28	38.11
	(51.72)[a]	(52.72)	(52.22)						
No Incentive	33.75	20.50		3.56	4.56	4.06	36.93	38.09	37.51
	(48.28)	(47.28)	(47.78)						
Totals	34.88	21.69		4.16	4.81	4.48	37.44	38.18	37.81
	(50.00)	(50.00)	(50.00)						

Note. Maximum posttest score for the related program = 44

Maximum posttest score for the unrelated program = 30

n = 16 for each treatment group.

[a]Numbers in parenthesis are standard scores.

As shown on Table 2, the mean standard score for the incentive group was 50.16 and the mean for students in the no-incentive group was 49.84. This difference in posttest scores was not significant. A comparison of raw scores for each program between the experimental session and the follow-up session was also conducted. For each program, the differences were less than one point and were not statistically significant.

Significant differences associated with incentives were observed in the follow-up session for both study time and attitude ratings. Mean study time (Table 2) was significantly higher for the incentive group (37.06 minutes) than for the no-incentive group (31.84 minutes), F (1, 60) = 10.18, p <.002. Students under the incentive condition also gave significantly higher attitude ratings (Appendix A) than students under the no-incentive condition to items dealing with their level of motivation (Item 4), their level of understanding of the program terminology (Item 5), and their effort (Item 9). It was expected that differences in effort in the follow-up session might occur between the incentive and no-incentive groups on the unrelated program. However, inspection of the data on page 35 on the motivation and effort items (Items 4 and 9) indicate that the significant differences on these items were due primarily to differences favoring the incentive group on the course-related program, rather than on the unrelated program. Students rated their effort quite high (Item 9) in both the experimental session (2.27) and the follow-up session (2.17).

Table 2

Means of Dependent Variables by Incentive and Program:

Follow-up Session, Experiment 1

	Posttest Scores			Program Errors			Instructional Time in Minute		
Treatment	Related	Unrelated	Totals	Related	Unrelated	Totals	Related	Unrelated	Totals
Incentive	35.38	22.19		3.00	3.97	3.48	33.97	40.15	37.06*
	(51.01)	(49.30)	(50.16)						
No Incentive	34.12	22.75		3.12	4.37	3.74	28.81	34.88	31.84*
	(48.99)	(50.70)	(49.84)						
Totals	34.75	22.47		3.06	4.17	3.61	31.39**	37.52**	34.45
	(50.00)	(50.00)	(50.00)						

Note. Maximum posttest score for the related program = 44

Maximum posttest score for the unrelated program = 30

n = 16 for each treatment group

[a]Numbers in parenthesis are standard scores.

* $p < .002$

** $p < .004$

EXPERIMENT 2

Experiment 2 was designed to investigate the effects of a student-selected incentive (as contrasted with the instructor-selected incentive offered in Experiment 1) on students' posttest performance and study time across two instructional tasks, both related to course content. The incentives offered were specific instances of the types of incentives rated in the Bebeau et al. (1977) study.

Method

Subjects

Subjects for this study were the same 64 students who participated in Experiment 1. Participation in this experiment was optional. All students elected to participate in Experiment 2, but four were absent when the materials were distributed and two others failed to attend the test session.

Materials

The two instructional programs used in the experiment were modified versions of "Analyzing and Sequencing Instruction" and "Appropriate Practice" by Popham and Baker (1970). Instruction and practice exercises in the original programs were modified to correspond with the course objectives.

A 40-point posttest was constructed for each program using items from the original tests and additional items from the course pool of items. The test for "Analyzing and Sequencing Instruction" (Sequencing Program) contained 5 selected-response items scored on a two-point-per-item basis and 13 constructed-response items on which point values varied from item to item. The test for "Appropriate Practice" (Practice Program) contained 20 selected-response items (1 point per item) and 4 constructed-response items on which points varied from item to item. Point values on the constructed-response items for both tests were determined by the relative importance of each item to the content. The selected-response items in both programs and on the posttests involved identification of exemplars of given concepts, with different exemplars in the practice items than on the posttest. Two kinds of constructed-response items were included on each program posttest. One type required the student to generate instances of concepts for a specific topic; e.g., give an example of analogous practice for the following objective: "to give a speech." The topics presented in the practice items were different from those on the posttest. A second type of constructed-response item required the student to state distinguishing characteristics of concepts

or to state a rule or series of rules to follow when making the discriminations on the selected-response items. These constructed-response items are memory-type items and consequently were identical to the practice items presented in the instructional materials.

The measure of student incentive preferences (Appendix C) prepared for this study was similar in form to a portion of the measure designed to gather normative data on student incentive preferences (Bebeau et al., 1977). Six incentives, representative of the categories presented in the preference study, were selected and operationalized in the context of the Competency-Based Instruction course. The incentives were:

(1) Release from one final application assignment. (Students needed to apply skills learned in prior units to complete the three application assignments.)

(2) An option to substitute the score earned on the posttest for the designated experimental program for any unit test score (each test has 40 points).

(3) An invitation to participate in a small group discussion with the developer of the SWRL-Ginn Kindergarten Reading Program on the topic "objectives-based programs as they relate to individual learning styles and ethnic and socioeconomic background."

(4) A positive letter of reference for the student's placement file.

(5) An opportunity to assist the instructor with the grading of application assignments.

(6) No reward.

Procedures

In a class period preceding the distribution of the two self-instructional programs, students completed an incentive preference measure designed for this study. After rating each incentive, each student selected the incentive he or she most preferred as a reward for high performance on a course-related task. Students were informed that they could elect to work for this incentive, but that the particular program for which the incentive could be earned would be predetermined. Students were also informed that both programs contained instruction on course objectives which would be assessed on the unit test.

In order to give all students an opportunity to earn an incentive, two instructional programs were selected to study incentive effects. The programs were the Sequencing Program and the Practice Program. Each

student completed one program under an incentive treatment and the other under a no-incentive treatment. To minimize potential order effects, materials and incentive directions were arranged in booklets so that all four possible sequences were represented. Students were then randomly assigned to one of the following orders:

(1) Sequencing Program (incentive) followed by Practice Program (no incentive);

(2) Sequencing Program (no-incentive) followed by Practice Program (incentive);

(3) Practice Program (incentive) followed by Sequencing Program (no-incentive);

(4) Practice Program (no-incentive) followed by Sequencing Program (incentive).

Each student received an envelope containing program materials with directions to study the materials in preparation for a test to be given during the next regularly scheduled class meeting (four days later). An instruction sheet preceding the program (Appendix D) for which the incentive could be earned informed students of the presence of the incentive conditions. Students were informed that a posttest score of 80 percent or above was required to earn the incentive and that it could only be earned on the program indicated by the directions. Students took the materials home to study them and to complete the practice exercises. They were asked to record study time on the practice exercise form. The two program tests were administered during the next regularly scheduled class period. The two tests for each student were arranged in the same order as the instructional materials.

Results

A multivariate analysis of variance was conducted for each program to assess the effects of incentive treatments (incentive vs. no-incentive) on posttest scores and study time differences. The multivariate F test for the Sequencing Program indicated a significant effect for incentive, F (5, 52) = 2.70, p <.03. The multivariate F test for the Practice Program revealed that differences for this program were not significant, F (6, 51) = 1.77, p <.12.

Posttest Scores

Table 3 shows the posttest mean scores for the Sequencing Program for each treatment group on each of the four subtests and on the total 40-item test. The total mean score of 26.17 (65 percent correct) for the incentive group was significantly higher than the mean score of 21.46 (54 percent correct) for the no-incentive group, F (1, 56) = 6.28, p <.01.

Table 3

Posttest Mean Scores by Treatment and Subtest:

Sequencing Program, Experiment 2

		Subtest Section				
	n	1	2	3	4	Total
Points Possible		4	9	17	10	40
Treatment						
Incentive	30	3.36	6.00	9.67**	7.13	26.17*
No Incentive	28	3.07	6.14	5.89**	6.36	21.46*
Totals		3.22	6.07	7.78	6.75	23.82

* $p < .01$

** $p < .002$

As seen in Table 3, most of the significant difference by treatment occurred on a subtest section of the program test. On Subtest 3 of the Sequencing Program, the mean score of 9.67 (57 percent correct) for the incentive group was significantly greater than the mean score of 5.89 (34 percent correct) for the no-incentive group, F (1, 56) = 10.50, p <.002. This difference of 4.7 points accounted for most of the statistically significant difference in scores between treatments on the total test.

The mean posttest scores for the Practice Program are shown in Table 4. A mean score for the incentive group was 34.96 (87 percent correct) and the mean score for the no-incentive group was 33.43 (83 percent correct). The multivariate test indicated no overall incentive differences. However, examination of the univariate tests indicated that, as on the Sequencing Program, differences were apparent on one of the subtests. On Subtest 5 of the Practice Program, the mean score of 7.54 (84 percent correct) for the incentive group was significantly higher than the mean score of 6.03 (67 percent correct) for the no-incentive group, F (1, 56) = 8.80, p <.004.

Further analysis of the characteristics of the subtest sections was performed in an effort to determine the factors responsible for incentive differences associated with subtest scores. Table 5 lists the item types (constructed and selected response) and the performance requirements associated with each subtest for two programs. It can be seen that Subtest 3 of the Sequencing Program and Subtest 5 of the Practice Program both required students to state one or more rules that required the memorization of several subparts. Subtest 1 on the Sequencing Program also required the memorization of rules. However, examination of the test indicated that the rules required in Subtest 1 were simple definitions which could be committed to memory with a minimal amount of rehearsal. Additionally, the section that followed required the students to generate instances of these definitions, a process that should help commit the rule to memory. The rules the student was required to state in Subtest 3 (Sequencing Program) and Subtest 5 (Practice Program) were not simple definition types. Each required the students to commit to memory several main points and series of subpoints. The sections that followed these subtests did not require the student to generate instances of the definitions as in the case of Subtest 1 of the Sequencing Program.

Incentive Ratings

Mean ratings for each of the six incentives rated prior to the experiment are presented in Appendix C. Also shown is the percentage of students who selected each incentive as their first preference. The opportunity to substitute a high test score for a lower test score was the first preferred of 54 percent of the students and received the highest mean rating (1.58) on the seven-point scale. The opportunity to earn release

Table 4

Posttest Mean Scores by Treatment and Subtest:

Practice Program, Experiment 2

		Subtest Section					
	n	1	2	3	4	5	Total
Points Possible		10	6	10	5	9	40
Treatment							
Incentive	30	8.75	4.86	9.14	4.68	7.54*	34.96
No Incentive	28	8.47	5.10	9.27	4.57	6.03*	33.43
Totals		8.61	4.98	9.20	4.62	6.78	34.20

*$p < .004$

Table 5

Item Type and Performance Requirement for Each Subtest of the Sequencing Program and the Practice Program

Program	Item Type[a]	Performance
Sequencing Program		
Subtest 1	C	state rules #1 and #2
Subtest 2	C	generate instances of rules #1 #2
Subtest 3		state rules #3-6 (each rule has several subparts)
Subtest 4	S	identify instances of rules #3-6
Practice Program		
Subtest 1	S	identify instances of rules #1-4
Subtest 2	C	generate instances of rules #1-4
Subtest 3	S	identify instances of rule #5
Subtest 4	S	identify instances of rule #6
Subtest 5	C	state rule #6 (rule has several subparts)

[a]C = constructed response; S = selected response

from an assignment was the first preferred by 35 percent of the students and had a mean rating of 1.66. Students rated the opportunity to earn a letter of reference favorably (2.50) but only 11 percent of the students selected it as their first preference. The other two incentives and the no-reward option were not selected by any student and had relatively low mean ratings. The Pearson product-moment correlation between the ratings of these six specifically described incentives and the normative ratings of the six corresponding incentive categories in the Bebeau et al. (1977) study was .85, indicating high consistency of preferences between students in this study and those in the normative study.

Instructional Time

Time spent studying the instructional materials was recorded by all students. Although students in the incentive group for the Sequencing Program averaged 14 minutes longer than students in the no-incentive group (73.46 to 59.46), this difference was not statistically significant, F (1, 56) = 2.87, p <.09. Mean study times of 54.79 for the incentive group and 53.47 for the no-incentive group on the Practice Program were not significant.

EXPERIMENT 3

The purpose of Experiment 3 was to determine the effects of a highly preferred incentive, release from final examination (Bebeau et al., 1977), when used under typical instructional procedures in a unit of instruction of approximately two weeks duration in a one-semester university course. Effects of the incentive were studied on posttest performance, study time, student-initiated contact with the instructor, and student attitude toward the use of incentives.

Method

Subjects

Subjects for this experiment were 59 upper-division undergraduate students enrolled in the Competency-Based Instruction course at Arizona State University during the spring semester, 1977. Both daytime sections were taught by the same instructor with the aid of a graduate teaching assistant.

Materials

For purposes of this experiment, the regular instructional materials for the second unit of the Competency-Based Instruction course were prepared in a self-instructional programmed format. Much of the content of the self-instructional program had undergone extensive tryout and revision during the three years the course had been taught. The program contained instruction, practice exercises, and feedback for the four unit objectives listed below:

(1) to distinguish between instructional objectives and instructional activities;

(2) to identify worthwhile instructional objectives;

(3) to identify well-written instructional objectives;

(4) to write instructional objectives.

Since feedback on the fourth objective could not be given most effectively in self-instructional format, two of the three optional practice sessions provided additional practice and feedback on this objective. Students could elect to attend one or more of these sessions.

Three practice exercises were prepared for the optional practice sessions. Exercise 1 contained 30 items--ten selected-response items for each of the first three objectives. Exercises 2 and 3 were identical

in form, each containing five constructed-response items for the fourth objective.

The 40-point posttest for the unit consisted of 10 two-alternate selected-response items (one point each) for each of the first three unit objectives and five constructed-response items (two points each) for the fourth objective. The total score for the test was 40 points, 10 points for each subtest.

An attitude survey, consisting of 11 statements about the instruction, practice sessions, and use of the incentive was administered to students at the end of the unit test. Students were asked to indicate on a five-point scale the degree to which they agreed or disagreed with each statement. A copy of the attitude survey is included in Appendix E.

Procedures

The incentive for this experiment was the opportunity to earn release from the course final examination. During the semester each student was given one opportunity to earn this incentive for good performance (80 percent correct) on a unit test. For the purpose of this experiment, half the students were given an opportunity to earn the incentive on Unit 2. The other half could earn the incentive for good performance on either Unit 3 or Unit 4--the particular unit for which they could earn it was randomly assigned. Attaining the criterion score on the particular test for which the incentive could be earned meant that the student was exempt from taking the final examination and automatically earned a perfect score. If the established criterion was not met, the student took the final examination and was assigned only the total points obtained on the test. Students who did not have the opportunity to earn release from the final examination on Unit 2 served as the no-incentive group. However, points obtained on the Unit 2 test counted toward the course grade for both the incentive and no-incentive treatments.

The Competency-Based Instruction course was divided into five units. During an introductory unit, course procedures and the characteristics of a competency-based instructional program were described. There was no formal assessment for this introductory unit, which was completed during the first two weeks of the semester. Time for the second unit, the one during which the experiment was conducted, was three weeks.

During the first class meeting of the spring semester a course syllabus listing course objectives, course requirements, and the basis for determining grades was distributed to both sections. Total points accumulated on four unit tests (each worth 40 points) and three application assignments (each worth 20 points) were the basis for grade assignment.

To help students estimate the value of the performance-contingent incentive offered as a part of the experiment, students were informed of the estimated range of scores for course grades (195-220 points = A, etc.). These scores were established on the basis of past performance in the course.

Students were pretested during the second class meeting on a measure that included items selected from practice materials used during the course. After the pretest, the information related to the opportunity to earn release from the final examination for good test performance was given. The particular unit test for which the incentive could be earned varied between treatment groups, but all students were informed of the presence of the incentive condition and the unit on which the incentive could be earned prior to instruction on Unit 2.

Prior to the beginning of Unit 2, students in both sections were randomly assigned to the incentive and no-incentive treatments. Examination of the pretest scores (13.2 for the incentive group and 14.1 for the no-incentive group) indicated no significant performance difference between the groups. Self-instructional materials, directions for using the materials, and a schedule of the unit activities were distributed at the beginning of the unit.

The directions described the presence or absence of the opportunity to earn an incentive for good program performance. Guidelines for working through the program and for deciding whether to attend the optional practice sessions were also included. The guidelines informed students that if they did well in the program, it was an indication they would do well on the test, but that if they missed several items in the program, it was likely that they could profit from the optional practice sessions. All students were told that they were welcome to participate in the optional sessions even if they did extremely well throughout the program.

The unit schedule given to students listed the date that the test would be given and the dates and a description of the three optional practice sessions. One session was scheduled for review and additional practice on the first three objectives, and two sessions were scheduled for review and additional practice on the fourth objectives. Complete directions and the schedule are included in Appendix F.

The test was administered two and one-half weeks after the materials were distributed. The attitude scale was given immediately after the test. The last class period on the three-week unit was used to provide feedback on the test.

Design and Data Analysis

The design for this study was a pretest-treatment-posttest experimental design with random assignment of students to incentive and no-incentive treatments. A multivariate analysis of variance was used to assess the effects of incentive treatments on (a) posttest performance, (b) study time, and (c) attendance at optional practice sessions.

Results

The multivariate F test indicated a significant effect for incentive, F (6, 52) = 2.49, p <.03. The means obtained by the two treatment groups on each of the dependent measures are shown in Table 6. The difference in mean scores between the incentive group (34.46) and the no-incentive group (35.20) was less than one point. The overall mean percentage correct was 87 percent.

Because incentive differences were previously observed on constructed-response items, an analysis of subtest scores was also included. Examination of the univariate tests indicated a statistically significant difference, F (1, 57) = 4.31, p <.04, between the mean score of 9.17 attained on Subtest 4 by the no-incentive group and the mean incentive group score of 8.53. The significant difference on Subtest 4 was not in favor of the incentive group, as had been the case with constructed-response items that required the memorization of rules (Experiment 2). Subtest 4 required students to construct examples of instructional objectives when given subject-matter topics. Since pre-instructional differences on Subtest 4 could account for the observed post-instructional difference, an analysis of pretest subtests was also performed. The means and variances for the incentive (2.30, SD = 1.95) and no-incentive groups (2.34, SD = 2.15) were nearly identical on the pretest.

Table 5 also contains data on mean study time, program errors, and attendance at optional practice sessions. Students in the incentive group spent an average of 56 minutes longer studying the materials than students in the no-incentive group (266 minutes to 210 minutes), a difference that was not statistically significant. The average number of errors while completing the program was 5.16 for the incentive group and 6.13 for the no-incentive group. Students in the incentive group attended an average of 1.96 practice sessions as compared with 1.51 sessions attended by the no-incentive group. Neither the difference in program errors nor the difference in practice sessions was statistically significant.

Responses to the attitude survey are summarized in Appendix D. In general, students responded favorably to the instruction and use of the incentive. The only significant difference occurred on Item 7, "The

Table 6

Means of Dependent Variables by Incentive Condition:

Experiment 3

Treatment	n	Posttest Scores: Subtest Section 1	2	3	4	Total	Attendance[a]	Errors	Instructional Time in Min.
Incentive	30	8.97	8.60	8.36	8.53*	34.46	1.96	5.16	265
No Incentive	29	8.59	9.17	8.27	9.17*	35.20	1.51	6.13	209
Totals		8.78	8.87	8.32	8.85	34.83	1.74	5.66	237

Note. Maximum Posttest Score = 40 (10 for each Subtest).

[a]Student attendance at 3 optional practice sessions.

*$p < .04$.

practice sessions increased my understanding of the materials," which was rated significantly higher by students in the no-incentive group (mean rating = 1.28) than by those in the incentive group (mean = 1.72), $t(40) = 2.42$, $p < .02$.

DISCUSSION

The present research was conducted to determine the effects of preferred incentives on the performance of college students across instructional tasks that varied in length and relatedness to the course content. Grade-related contingencies are present in the no-incentive condition when course-related materials are used, so incentive differences were expected to be more evident for material that was unrelated to the course than for material that was course-related. Students offered an incentive were expected to demonstrate greater effort and consequently better posttest performance. Student reports of effort expended and reports of study time were collected to insure sensitivity to incentive differences that may be masked by factors related to instructional effectiveness. Significant relationships between incentives and performance were observed on four of the five instructional tasks employed in these experiments. However, the overall effects of incentives were not exactly as predicted.

In the first study, no significant differences were noted in posttest performance on either a course-related or an unrelated task when points toward the course grade were used as an incentive. In the second study, performance of students under a self-selected contingency was compared with students that were in a no-incentive treatment on two course-related tasks. Incentive students performed significantly better than no-incentive students on certain program subtests--subtests that required the student to state a list of rules that had been memorized. In Experiment 3, the effect on student performance of release from final examination was investigated under typical instructional conditions in a university course. In this case, students in the no-incentive condition scored significantly higher than students in the incentive condition on the constructed-response items for this instructional task.

Incentives appeared to affect performance on certain types of items. Four kinds of constructed-response and two kinds of selected-response items were present in the five instructional programs used to assess incentive effects. On constructed-response items that required students to memorize a lengthy set of rules (Experiment 2), incentives clearly facilitated performance ($p < .004$). Conversely, on constructed-response items that required students to apply a series of rules when generating examples that conformed to the rules (Experiment 3), performance was significantly higher under a no-incentive condition, though the

difference was not of great magnitude nor as evident from the raw scores. No significant differences were observed for constructed-response items that required students to define a simple concept or generate instances of a single concept.

There is evidence from paired-associate studies (Cuvo, 1973) that incentive level influences rehearsal and that rehearsal, in turn, influences word-recall scores. However, word-recall scores were not affected by incentive level in the absence of rehearsal opportunities. In each of the present experiments, study time was allowed to vary. On the Sequencing Program (Experiment 2), where incentives had the most noticeable effect on constructed-response items of the memory type (i.e., recall-type items as in the Cuvo study), the reported mean study time of students in the incentive group was 14 minutes longer than that of students in the no-incentive group. Although this difference in reported study time was not statistically significant, it seems possible that the longer study time of the incentive group may have influenced their performance on the recall-type constructed-response items.

Incentives did not facilitate performance on selected-response items in any of the experiments. The facilitative effect of incentives on selected-response memory-type items was observed by Reid. He noted that, under conditions of high reward, students requested additional review time and used it to study the test questions and answers. The selected-response items in the Eye Program (Experiment 1) were memory-type items, but no significant differences for measures of effort or performance were obtained on this program. It may be that students were unaware that rehearsing the items would assist them in answering the test questions. Selected-response items in the other programs were concept-classification items. It seems probable that performance is less likely to be affected by differences in rehearsal time on concept-classification items than on memory items because the former require the application of concepts rather than memorization of factual information. Additionally, increases in effort on concept-classification items may be moderated by factors related to the design of instruction, such as the care with which practice and test items are selected from a domain of items, the extent to which the instruction facilitates concept attainment, and whether the test contains new exemplars of concepts in contrast to previously encountered exemplars.

The negative finding on a task that required new applications of a large number of rules was not expected. Caution must be taken in interpreting these results since the significant difference ($p < .04$) was based on a .64-point difference between the groups on a 10-point subtest containing five items. Previous observations of an incentive decrement effect are reported by Eubanks (1976) on a task that required new applications of visually-presented and verbally-presented concepts. Incentives had consistently facilitated some aspect of performance in earlier studies

using the same task (Reiser, 1975; Tenpas & Higgins, 1974), but when Eubanks studied incentive effects with students who had low pretest scores on the task, the effect of incentives on performance was negative. In the present research (Experiment 3), low pretest scores indicated that these students also were unable to perform the task prior to instruction. Whether negative incentive effects may occur frequently in situations in which students are required to make new applications of concepts that are highly unfamiliar prior to instruction is speculative. Strong confidence in the reliability and generality of such an effect should be contingent on further observations of its occurrence.

An expected consequence of an effective incentive is an observable increase in effort. In the experimental session for Experiment 1, no significant differences in effort were reported for either the course-related or unrelated task. In the follow-up session, significant differences in effort were reported for the incentive group on the course-related task, but there was no evidence that the additional effort improved posttest performance. On the course-related task, both the incentive and no-incentive groups performed poorly on items that required the stating of definitions. The program did not include practice items that required the student to state the definitions. Though objectives preceding the program indicated that the ability to state definitions would be assessed on the test, students evidently failed to use this information in a manner that resulted in increased effort and effectiveness in learning the definitions.

On the unrelated program, students under the incentive condition were expected to demonstrate significantly greater effort and consequently better performance in both the experimental and follow-up sessions. Yet, the availability of points toward the course grade did not result in significantly higher posttest performance than whatever motivated students in the no-incentive group to study the unrelated material. The high attendance at the follow-up session among no-incentive students in the unrelated program indicates higher-than-expected motivation among these students. Perhaps the motivation resulted in part from the instructor's statement that the experimental materials would form the basis for later discussions of instructional principles.

One important finding relates to the selection of incentives for classroom use. Grade-related incentives are the most preferred from among the types of incentives available to classroom instructors. In Experiment 2, an attempt was made to describe both grade-related and non-grade-related incentives in a manner that would have high appeal for students enrolled in a particular class. The sharply lower ratings given potential incentives that were not grade-related were consistent with earlier normative ratings of the incentive categories. None of the students elected either the opportunity to assist the instructor or the invitation to attend a discussion with an authority on a high-interest topic. Only a few students selected a favorable letter of reference as their first preference.

Though overall student preferences for incentives in Experiment 2 were quite consistent with the preferences indicated in the earlier normative studies by Bebeau et al. (in press; 1977), there was a variation with respect to the grade-related incentive and release from the final examination. In this study, a larger percentage of students selected the option to substitute a potential high score for a previously earned low score than the option to earn release from a final course assignment. Conversely, in the normative study release from final examination was selected over points toward the course grade 75 percent of the time.

Evidence from these experiments and previous research suggests that incentive effects would be most evident for memory tasks provided the student is aware that memory is a task requirement and that it will be facilitated by rehearsal. The precise effect of using external incentives with concept-classification or problem-solving tasks is not clear, but it is obviously related to the effectiveness of the instruction on the tasks. The apparent negative effect of incentives on tasks that require new applications of rules or concepts, as observed in this study and in the Eubanks (1976) studies, indicates the need for additional investigations of the generalizability and reliability of this effect. Further study of the effects of incentives on various types of tasks should contribute to identification of the most effective ways to enhance learning in university settings.

References

Bebeau, M. J., Eubanks, J. L., & Sullivan, H. J. Incentive preferences of introductory psychology students. Teaching of Psychology, in press.

Bebeau, M. J., Sullivan, H. J., & Eubanks, J. L. Learning incentives preferred by university students. AFHRL-TR-77-9, AD-A041 733. Williams AFB, AZ: Flying Training Division, Air Force Human Resources Laboratory, May 1977.

Cuvo, A. J. The development of incentive level influence on overt rehearsal and free recall of unrelated words. Paper presented at the Eighty-First Annual Convention of the American Psychological Association, Montreal, Canada, August 27-31, 1973. (ERIC Document Reproduction Service No. ED 088 570)

Deci, E. L. Effects of externally mediated rewards on intrinsic motivation. Journal of Personality and Social Psychology, 1971, 18, 105-115.

Deco. E. L. Intrinsic motivation, extrinsic reinforcement and inequity. Journal of Personality and Social Psychology, 1972, 22, 113-120.

Eubanks, J. L. Differential incentive effects under varying instruction conditions. AFHRL-TR-76-11, AD-A028 477. Williams AFB, AZ: Flying Training Division, Air Force Human Resources Laboratory, July 1976.

Frase, L. T., Patrick, E., & Schumer, H. Effect of question position and frequency upon learning from text under different levels of incentive. Journal of Educational Psychology, 1970, 61, 52-56.

Gold, R. M., Reilly, A., Silberman, R., & Lehr, R. Academic achievement declines under pass-fail grading. Journal of Experimental Education, 1971, 39, 17-21.

Hakel, M. D., Klimoski, R. J., & Wood, M. T. Management of social incentives in Air Force technical training: A field experiment. AFHRL-TR-75-11, AD-A016 727. Lowry AFB, CO.: Technical Training Division, Air Force Human Resources Laboratory, September 1975.

Halcomb, C. G., & Blackwell, P. Motivation and the human monitor: I The effect of contingent credit. Perceptual and Motor Skills, 1969, 28, 623-269.

Hiller, J. H., Deichman, J. W., & Pirkle, J. K. Expectancy to teach: A possible incentive for learning. Journal of Experimental Education, 1973, 42(1), 37-39.

Komaki, J. The effects of reinforcement contingencies indigenous to college classrooms. Paper presented at the Eighty-First Annual Convention of the American Psychological Association, Montreal, Canada, August 27-31, 1973. (ERIC Document Reproduction Service No. ED 083 903)

Komaki, J. Neglected reinforcers in the college classroom. Journal of Higher Education, 1975, 46(1), 63-74.

Lloyd, K. E., Garlington, W. K., Lowry, D., Burgess, H., Euler, H. A., & Knowlton, W. R. A note on some reinforcing properties of university lectures. Journal of Applied Behavior Analysis, 1972, 5, 151-156.

McKeachie, W. J. Instructional psychology. Annual Review of Psychology, 1974, 25, 161-191.

O'Day, E. F., Kulhavy, R. W., Anderson, W., & Malczynski, R. Programmed instruction: Techniques and trends. New York: Appleton-Century-Crofts, 1971.

Popham, W. J. Evaluating instruction. New Jersey: Prentice-Hall, 1973.

Popham, W. J., & Baker, E. I. Planning an instructional sequence. New Jersey: Prentice-Hall, 1970.

Reiser, R. A. Effects of systematic variations of instructional variables in a verified instructional program. Paper presented at the Annual Meeting of the American Educational Research Association, Washington, D. C., April 1975. (ERIC Document Reproduction Service No. ED 106 661)

Sullivan, H. J., Baker, R. L., & Schutz, R. E. Effects of intrinsic reinforcement contingencies on learner performance. Journal of Educational Psychology, 1967, 58, 165-169.

Sullivan, H. J., Schutz, R. E., & Baker, R. L. Effects of systematic variations in reinforcement contingencies on learner performance. American Educational Research Journal, 1971, 8, 135-142.

Tenpas, B. G. & Higgins, N. C. Practice and incentive effects on learner performance: Aircraft instrument comprehension task. AFHRL-TR-74-104, AD-A011 616. Williams AFB, AZ: Flying Training Division, Air Force Human Resources Laboratory, December 1974.

Wolk, S., & DuCette, J. Monetary incentive effects upon incidental learning during an instructional task. Journal of Educational Psychology, 1974, 66, 9-95.

Wood, M. T., Hakel, M. D., Del Gaizo, E. R., & Klimoski, R. J. Identification and analysis of social incentives in Air Force technical training. AFHRL-TR-75-10, AD-A017 871. Lowry AFB, CO.: Technical Training Division, Air Force Human Resources Laboratory, October 1975.

Reference Notes

1. Anderson, R. C. Personal communication, April 1975.

2. Bebeau, M. J., & Eubanks, J. L. Effects of incentives and study conditions on learner performance. Unpublished manuscript, 1976. (Available from M. J. Bebeau, Department of Educational Technology, Arizona State University, Tempe, Arizona).

APPENDIX A

ATTITUDE SURVEY: EXPERIMENT 1

Student Responses to Attitude Survey:
Experiment I: Experimental Session

Students circled numbers that appeared to the right of each statement as follows:

1 = strongly agree with statement
2 = agree with statement
3 = neither agree nor disagree
4 = disagree with statement
5 = strongly disagree with statement

			Related	Unrelated	Total
1.	I learned a lot from this program.	I[b]	2.88	2.69	2.78
		NI[b]	3.00	2.94	2.97
			2.94	2.82	2.88
2.	I enjoyed working through this program.	I	3.38	3.19	3.28
		NI	3.19	3.31	3.25
			3.28	3.25	3.26
3.	I knew much of this content before I took this program.	I	3.88	3.94	3.91
		NI	3.19	4.19	3.69
			3.54	4.06	3.80
4.	I was motivated to do well on this program.	I	2.75	2.50	2.62
		NI	3.25	3.06	3.16
			3.00	2.78	2.89
5.	It was easy to understand the terminology used in this program.	I	3.38	3.75	3.56
		NI	3.44	3.19	3.32
			3.41	3.47	3.44
6.	The instruction was presented in a clear format.	I	2.88	2.69	2.78
		NI	3.12	2.06	2.59
			3.00*	2.38*	2.68
7.	I felt frustrated as I worked through this program.	I	2.56	3.00	2.78
		NI	2.94	2.94	2.94
			2.75	2.97	2.86
8.	I would have preferred learning the content of this program through the lecture-discussion approach.	I	2.50	2.31	2.40
		NI	2.12	3.00	2.56
			2.31	2.66	2.48
9.	I tried hard to learn the content from this program.	I	1.94	2.38	2.16
		NI	2.06	2.69	2.38
			2.00**	2.54**	2.27

[b] I = Incentive Treatment; NI = No Incentive Treatment.

* $p < .05$ ** $p < .01$

Student Responses to Attitude Survey:
Experiment I: Follow-Up Session

Students circled numbers that appeared to the right of each statement as follows:

1 = strongly agree with statement
2 = agree with statement
3 = neither agree nor disagree
4 = disagree with statement
5 = strongly disagree with statement

			Related	Unrelated	Total
1.	I learned a lot from this program.	I[b]	2.38	2.38	2.38
		NI[b]	2.94	2.62	2.78
			2.66	2.50	2.58
2.	I enjoyed working through this program.	I	2.69	3.12	2.90
		NI	3.31	3.19	3.25
			3.00	3.16	3.08
3.	I knew much of this content before I took this program.	I	3.12	3.75	3.44
		NI	3.19	4.00	3.60
			3.16***	3.88***	3.52
4.	I was motivated to do well on this program.	I	2.06	2.75	2.40**
		NI	3.06	2.94	3.00**
			2.56	2.84	2.70
5.	It was easy to understand the terminology used in this program.	I	2.38	2.88	2.63**
		NI	3.38	3.19	3.28**
			2.88	3.04	2.96
6.	The instruction was presented in a clear format.	I	2.25	2.25	2.25
		NI	3.06	2.12	2.59
			2.66	2.18	2.42
7.	I felt frustrated as I worked through this program.	I	3.00	3.12	3.06
		NI	3.31	3.12	3.22
			3.16	3.12	3.14
8.	I would have preferred learning the content of this program through the lecture-discussion approach.	I	2.50	3.06	2.78
		NI	2.00	2.62	2.31
			2.25*	2.84*	2.54
9.	I tried hard to learn the content from this program.	I	1.56	2.25	1.90*
		NI	2.56	2.31	2.44*
			2.06	2.28	2.17

[b] I = Incentive Treatment; NI = No Incentive Treatment

* $p < .05$ **$p < .03$ ***$p < .002$

APPENDIX B

DIRECTIONS: EXPERIMENT 1

DIRECTIONS

This instructional program is one of two programs that have been developed to demonstrate principles of instruction for the Competency Based Instruction course. One program (Current Concepts in Measurement and Evaluation) covers content from Unit 3. You will be tested over this content on the Unit 3 test and on the final examination. The other program (The Structure and Function of the Eye) covers content that is not related to the course. Other than the test you take when you complete the program, there will be no further testing on the content. You will complete one program during this class meeting and the other during the next class meeting.

The results obtained from the two programs will form the basis for discussions of instructional principles in the fourth unit of the course. Participation in both related and unrelated programs is necessary for an understanding of the importance of certain instructional principles.

After you have completed the instructional program, you will be tested on its content. If you do well enough on the test, you will receive 10 points toward your course grade.*

This booklet deals with the distinctions between various measurement and evaluation concepts. It teaches content which will enable you to identify appropriate test items and to select tests for your instructional purposes. Practice questions are inserted periodically in the text. Use the following steps in working through the booklet.

(1) Read the textual material.

(2) Read the question and decide which alternative is correct.

(3) Mark your answer on the Program Answer Sheet using the special pen provided. PLEASE DO NOT MARK IN THIS BOOKLET.

(4) Proceed to the next textual material and repeat steps 1-3.

If you do not understand how to work through the program or how to use the Program Answer Sheet or special pen, raise your hand and ask the instructor to help you.

Please do not begin working until you are told to do so.

STUDY THE PROGRAM FOR AS LONG AS YOU WANT TO. When you have completed the entire book, record the time shown on the board and signal the instructor. You will then be given a short test to determine how effective the program was in teaching the various measurement and evaluation concepts. You may leave when you have finished the test.

*This statement was omitted in the no-incentive group.

DIRECTIONS

This instructional program is one of two programs that have been developed to demonstrate principles of instruction for the Competency Based Instruction Course. One program (Current Concepts in Measurement and Evaluation) covers content from Unit 3. You will be tested over this content on the Unit 3 test and on the final examination. The other program (The Structure and Function of the Eye) covers content that is not related to the course. Other than the test you take when you complete the program, there will be no further testing on the content. You will complete one program during this class meeting and the other during the next class meeting.

The results obtained from the two programs will form the basis for discussions of instructional principles in the fourth unit of the course. Participation in both related and unrelated programs is necessary for an understanding of the importance of certain instructional principles.

After you have completed the instructional program, you will be tested on its content. If you do well enough on the test, you will receive 10 points toward your course grade.*

This booklet deals with the structure and function of the eye. It teaches content with which you probably have little prior knowledge; therefore, it will provide a useful basis for a discussion of instructional principles. The text material is presented paragraph by paragraph in small steps. At the end of each paragraph, you will find a multiple-choice question. The paragraph of the text plus the multiple-choice question is referred to as a frame. In working through each frame, you will take the following steps:

(1) Read the paragraph of text material.

(2) Read the question and the five (5) alternatives of the text question.

(3) Decide which alternative is correct.

(4) Mark your answer on the answer sheet using the special pen provided. DO NOT MARK IN THIS BOOKLET. (See the special directions on the answer sheet.) You may re-examine a text paragraph as much as you like before answering the question.

(5) Proceed to the next frame and repeat steps 1-4.

NOTE: There is only one correct answer for each question.

During your reading you will be referred to another booklet labeled "Figures." These figures are drawings or illustrations which are useful in understanding the text. You may refer to these figures as often as you like, but do not advance to a new figure until told to do so by the text.

If you do not understand how to work through the program or how to use the answer sheet and special pen, raise your hand and ask the instructor to help you.

Please do not begin working until you are told to do so.

STUDY THE PROGRAM FOR AS LONG AS YOU WANT. When you have completed the entire booklet, record the time shown on the board and signal the instructor. You will then be given a short test to determine how effective the program was in teaching you the content. You may leave when you have finished the test.

*This statement did not appear for students in the no-incentive treatment group.

APPENDIX C

INCENTIVE PREFERENCE MEASURE AND MEAN RATINGS FOR INCENTIVES

INCENTIVE PREFERENCE MEASURE

On Thursday you will receive two chapters of self-instruction to take home and study. Each chapter has a 40-item posttest. You will take both tests on Tuesday. The content of the chapters covers the unit objectives for "Appropriate Practice" and "Sequencing Instruction," which are included on the unit test and final examination.

Beside each item below circle the number which represents how you would feel if the item were used to motivate you to do well on ONE of the chapter tests. Use the scale below.

Very Favorable			Neutral			Very Unfavorable
1	2	3	4	5	6	7

	Favorable						Unfavorable
___a positive letter of reference for your placement file if your grade in class is at least a B.	1	2	3	4	5	6	7
___the option to substitute your score on the 40-item test for your lowest score on a unit test in figuring your grade for the course.	1	2	3	4	5	6	7
___no reward at all.	1	2	3	4	5	6	7
___an opportunity to assist the instructor with the grading of application assignments. This provides an excellent learning experience.	1	2	3	4	5	6	7
___release from one application assignment. You will receive a score equivalent to the highest score attained by anyone in the class (20 points possible).	1	2	3	4	5	6	7
___participation in a 45-minute small group discussion with the developer of the SWRL-Ginn Kindergarten Reading Program on the topic "Objectives-based programs as they relate to individual learning styles and ethnic and socioeconomic background."	1	2	3	4	5	6	7

Now, look at each item again and put an X in the space next to the item you would most prefer as a reward for doing well. (Check only one.)

Would you like to have an opportunity to earn the incentive you most preferred when you complete the next self-instructional lessons? _____
yes/no

_____
signed

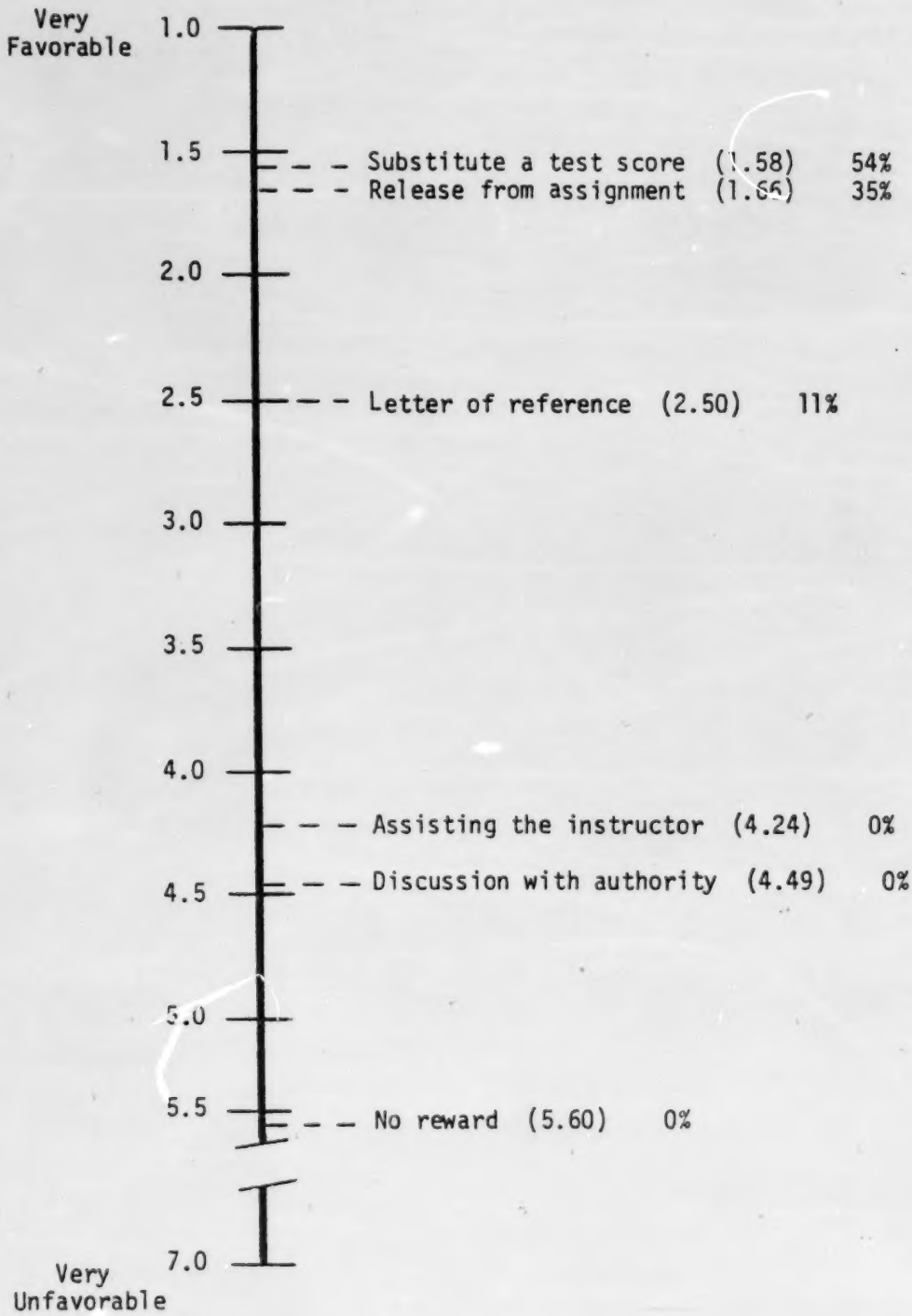

Figure 1. Mean values for 6 incentives derived through rating on a 7-point scale and percentage of students who selected each incentive as first preference.

APPENDIX D

DIRECTIONS: EXPERIMENT 2

DIRECTIONS

Study the materials in Chapter 1: ANALYZING AND SEQUENCING LEARNER BEHAVIOR.* You will be tested over this content during the next class period. IF YOU SCORE WELL (at least 80 percent correct), YOU WILL RECEIVE THE REWARD YOU SELECTED.

The reward you selected is checked (X) below.

___a positive letter of reference for your placement file if your grade in class is at least a B.

___the option to substitute your score on the 40-item test for your lowest score on a unit test in figuring your grade for the course.

___release from one application assignment. You will receive a score equivalent to the highest score attained by anyone in the class (20 points possible).

Remember, whether or not you receive the reward you selected will be determined solely upon your performance on the Chapter 1: ANALYZING AND SEQUENCING LEARNER BEHAVIOR.* You will take the other test, but your score on that test cannot be used to determine whether you receive the reward.

Please complete Chapter 1 before you begin Chapter 2.

Please keep an accurate record of the amount of time you spend on each chapter. Notice, there is a place on the answer sheet to record your time on each chapter.

NOW, WRITE YOUR NAME AND THE TIME IT IS NOW ON THE ANSWER SHEET. Use the enclosed card to cover the answers while you work.

YOU ARE NOW READY TO BEGIN.

*The chapter number and title varied for the four orders of presentation.

DIRECTIONS

Study the materials in Chapter 1: ANALYZING AND SEQUENCING LEARNER BEHAVIOR.* You will be tested over this content during the next class period, but YOUR PERFORMANCE ON THE TUESDAY TEST ON ANALYZING AND SEQUENCING LEARNER BEHAVIOR* WILL NOT AFFECT YOUR COURSE GRADE IN ANY WAY.

Use the program answer sheet to record your responses to the practice exercises. DO NOT WRITE IN THIS BOOKLET.

Please keep an accurate record of the TOTAL time you spend studying this chapter. There is a place on the answer sheet to record your time.

Please complete Chapter 1 before you begin Chapter 2.

NOW, WRITE YOUR NAME AND THE TIME IT IS NOW ON THE ANSWER SHEET. Use the enclosed card to cover the answers while you work.

YOU ARE NOW READY TO BEGIN.

*The chapter number and title varied for the four orders of presentation.

APPENDIX E

ATTITUDE SURVEY EXPERIMENT 3

Student Responses to Attitude Survey: Experiment 3

Students circled numbers that appeared to the right of each statement as follows:

1 = strongly agree with statement
2 = agree with statement
3 = neither agree nor disagree
4 = disagree with statement
5 = strongly disagree with statement

	Incentive[a]	No Incentive[b]
1. I learned a lot about writing objectives from this unit.	1.46	1.72
2. I enjoyed the instruction in this unit.	1.78	1.65
3. The instruction for this unit was presented in a clear manner.	1.32	1.34
4. I tried hard to learn the skills taught in this unit.	1.42	1.72
5. In the future, the instructor should advise all students to attend practice sessions.	2.50	2.37
6. I would have preferred that the instruction for this unit be given through the lecture method.	4.25	4.06
	Incentive[c]	No Incentive[d]
Students who did attend practice sessions responded to these statements:		
7. The practice sessions increased my understanding of the material.	1.72*	1.28*
8. I should not have attended the practice sessions.	4.50	4.45
	Incentive[e]	No Incentive[f]
Students who did not attend practice responded to this statement:		
9. I should have attended the practice sessions.	3.75	2.71
	Incentive[a]	No Incentive[b]
Students in the incentive treatment responded to this statement:		
10. Knowing that I could earn release from the final examination for good performance on the unit test influenced me to try: (check one) ___much harder than usual. ___harder than usual. ___about as hard as usual. ___not as hard as usual. ___not nearly as hard as usual.	2.25	
Students in the no-incentive treatment responded to this statement:		
11. If I could have earned release from the final examination for good performance on this test, I would have tried: (check one) ___much harder than usual. ___harder than usual. ___about has hard as usual. ___not as hard as usual ___not nearly as hard as usual.		2.30

[a] $n = 29$ [b] $n = 29$ [c] $n = 24$ [d] $n = 22$ [e] $n = 4$ [f] $n = 7$

*$p < .02$

APPENDIX F

DIRECTIONS: EXPERIMENT 3

DIRECTIONS

This packet contains an instructional program covering the four objectives for Unit 2. You may be able to master the unit objectives simply by studying the material in the packet. For those persons who want additional practice on these objectives, class time will be used for optional activities that provide such practice.

The test covering Unit 2 will be given on Wednesday, February 9. If you score at least 80 percent on the unit test, you will be excused from taking the final examination for this course. Except for class on Friday, January 28, you will not be required to attend class again until the class session for the unit test, Wednesday, February 9.

Class sessions for the purpose of providing feedback on the instructional program and additional practice on the four objectives will be as follows:

Monday, January 31	pages 1-20 (objectives 1-3)
Wednesday, February 2	(no class)
Friday, February 4	pages 21-27 (objective 4)
Monday, February 7	pages 21-27 (objective 4)

If you miss several items when completing pages 1-20 in the program, it is likely that you can profit from the practice session on January 31. Similarly, the practice sessions on February 4 and February 7 should be helpful if you have difficulty with the items on pages 21-27. Of course, you are welcome to participate in these sessions even if you do extremely well throughout the program.

Please keep a record of (1) the time you spend working through the program and (2) the time you spend reviewing for the test. Use the space below to record the time.

Time spent working through the program the first time: _____:_____

Time spent reviewing the material: _____:_____

When you answer an item or set of items in the program, mark your responses before looking at the answers. Use the enclosed card to cover the answer while you work. MARK YOUR ANSWERS DIRECTLY IN THE BOOKLET. Please leave your original answer to an item. If you wish to make any changes after looking at the answer, please do so with a different colored pen or pencil.

If you want to take a break while working through the program, the best places to do so are at the end of instruction on an objective. These places are indicated in the program by the word "BREAK."

You should finish instruction on the first three objectives (pages 1-20) before Monday, January 31.

DIRECTIONS

This packet contains an instructional program covering the four objectives for Unit 2. You may be able to master the unit objectives simply by studying the material in the packet. For those persons who want additional practice on these objectives, class time will be used for optional activities that provide such practice.

The test covering Unit 2 will be given on Thursday, February 10. Some students will have an opportunity to earn release from the course final examination for good performance on the test for this unit. You are not among this group. However, you will have your opportunity to earn release from the final examination for good performance on one of the other unit tests.

The class session on February 10 for the unit test is the next session you will be required to attend. The test will cover only the four objectives taught in the instructional program in your packet. The items on the test will be identical in type to the items that you answer in the program. If you do well in the program, it is an indication that you should do well on the test.

Class sessions for the purpose of providing feedback on the instructional program and additional practice on the four objectives will be as follows:

Tuesday, February 1	pages 1-20 (objectives 1-3)
Thursday, February 3	pages 21-27 (objective 4)
Tuesday, February 8	pages 21-27 (objective 4)

If you miss several items when completing pages 1-20 in the program, it is likely that you can profit from the practice session on February 1. Similarly, the practice sessions on Febraury 3 and February 8 should be helpful if you have difficulty with the items on pages 21-27. Of course, you are welcome to participate in these sessions even if you do extremely well throughout the program.

Please keep a record of (1) the time you spend working through the program and (2) the time you spend reviewing for the test. Use the space below to record the time.

Time spent working through the program the first time: _____:_____

Time spent reviewing the material: _____:_____

When you answer an item or set of items in the program, mark your responses before looking at the answers. Use the enclosed card to cover the answer while you work. MARK YOUR ANSWERS DIRECTLY IN THE BOOKLET. Please leave your original answer to an item. If you wish to make any changes after looking at the answer, please do so with a different colored pen or pencil.

If you want to take a break while working through the program, the best places to do so are at the end of instruction on an objective. These places are indicated in the program by the word "BREAK."

You should finish instruction on the first three objectives (pages 1-20) before Tuesday, February 1.

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